

**Before the  
Federal Communications Commission  
Washington, DC 20554**

In the Matter of	)	
	)	
Carrier Current Systems, including Broadband over	)	ET Docket No. 03-104
Power Line Systems	)	
	)	
Amendment of Part 15 regarding new requirements	)	
and measurement guidelines for Access Broadband	)	
over Power Line Systems	)	ET Docket No. 04-37

**Reply Comments of Aeronautical Radio, Inc.**

Aeronautical Radio, Inc. (“ARINC”) hereby submits its Reply Comments in these proceedings. The record makes clear that access broadband over power line service (“Access BPL”) can seriously interfere with the nation’s high frequency communications system that guards the safety of flight and thus should be authorized only under conditions that protect the HF Aeronautical Mobile (R) Service.

**Summary**

To fulfill its highest statutorily imposed duty – the protection of life and property – the Commission must act to prevent the build up of noise that will cause harmful interference in the Aeronautical Mobile (R) high frequency bands.<sup>1</sup> As ARINC showed in its Comments, its HF radio stations support both air traffic control and aeronautical operational control essential to the safe and efficient functioning of aircraft operating over ocean routes and in other remote areas of the world.<sup>2</sup> Unlike commercial wireless services employed by consumers, ARINC HF radio stations regularly handle voice and data traffic at the noise floor. By employing trained radio

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<sup>1</sup> 47 U.S.C. § 151 (2003).

<sup>2</sup> ARINC Comments at 2 – 3 (May 3, 2004). Others have also shown that HF service is employed in support of aviation. See, *e.g.*, Comments of Boeing.

operators, ARINC is able to receive messages from aircraft in flight in remote parts of the world even when the signals conveying these messages are at the noise floor and would be virtually indecipherable to casual listeners. As such, any actions that would raise this noise floor would impair the ability of ARINC to handle this vital safety traffic. In these Reply Comments, ARINC urges the Commission

- (1) to refrain from authorizing Access BPL to operate in the Aeronautical Mobile (R) bands,
- (2) to require use of a 10 meter measurement distance,
- (3) to standardize on a measurement antenna height of one meter above ground,
- (4) to employ a minimum of 5 dB as the correction factor to account for this low antenna height,
- (5) to use a 20 dB per decade fall off factor to predict field strength within the near field of HF signals,
- (6) to require that measurements be made on Access BPL systems under typical worst-case conditions with respect to measurement antenna locations, frequencies of operation, injection power, and data loading, and
- (7) to adopt NTIA's proposal that individual systems be certified instead of simply certifying Access BPL devices.

In order both to prevent and to remedy harmful interference, the Commission should require Access BPL operators to coordinate with ARINC whenever Access BPL operations are proposed to be initiated or changed within 24 kilometers (15 miles) of one of the ARINC HF transmit or receive sites. For its part, ARINC will provide information on such sites to the industry-sponsored entity responsible for the recordation of Access BPL operations. Each Access BPL operator should be required to make available a contact on a 24/7 basis for the prompt resolution of interference problems. Access BPL equipment should be required to incorporate the capability remotely to be turned on and off, to reduce power, and to alter its frequencies of operation including the ability to notch out bandwidth in 3 kHz wide channels

below 30 MHz. Finally, the Commission must reaffirm the secondary nature of Access BPL services and recognize that licensed services take precedence over the operation of Access BPL, including BPL operations that were instituted before the licensed services.

**I. The Propagation Modeling in the Record Demonstrates that Access BPL Operation in the Aeronautical Mobile (R) Service Must Not Be Permitted.**

Correct modeling and measurement of the Access BPL signals is essential to the development and implementation of a sound regulatory framework for the safe operation of Access BPL systems. In the *NPRM*, the Commission likened Access BPL more as a point source of radiation than as a line source in which undesired radio noise would be emitted along the length of power lines carrying BPL signals.<sup>3</sup> NTIA and the ARRL have shown that, in fact, Access BPL should be considered as a line source in that the undesired emissions from Access BPL are not limited to the immediate vicinity of Access BPL devices. Instead, power lines carrying Access BPL signals can – and usually will – radiate throughout their length. Indeed, the maximum radiation can occur at any fraction or multiple of a wavelength.<sup>4</sup> Moreover, the maximum angle of radiation, especially at the lower HF frequencies, can be at a high angle or even straight up posing both measurement inaccuracies and greater threats to aeronautical communications. Simulations conducted by ARINC engineers underscore these conclusions.<sup>5</sup>

In its Comments, ARINC emphasized that the Commission should exclude the Aeronautical Mobile (R) bands from Access BPL, *inter alia*, unless and until the agency has conclusive evidence based on both calculations and long-standing experience that Access BPL

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<sup>3</sup> See Notice of Proposed Rule Making, FCC 04-29, at ¶ 36 (rel. Feb. 23, 2004).

<sup>4</sup> NTIA Comments at 18-19 (June 4, 2004); ARRL Comments at 18 and Exhibit C (May 3, 2004).

<sup>5</sup> See Attachment A hereto depicting simulations conducted by ARINC. The simulations used 1 mW as the injection power. Even if this assumed power were to overstate the actual power to be used, the simulations show the antenna radiation patterns to be expected from Access BPL systems and the attenuation of field strength expected in the near field.

HF signals propagating through the ionosphere would not pose any interference threat to HF aeronautical communications. Recently, NTIA submitted an initial installment of Phase II of its review of Access BPL in which it concluded based on a computer analysis of the propagation of Access BPL signals via skywave that some 700,000 devices would raise the median ambient noise level by “less than 1 dB.”<sup>6</sup> NTIA then posited that under its “recommended rule elements, chiefly the 5 dB height correction factor and power control, it would take millions of BPL devices to increase the median noise by 1 dB.”<sup>7</sup> However, if BPL service lives up to its hype, tens of millions of homes and businesses could be served, and each of these would likely have one or more BPL devices to connect with the Access BPL infrastructure. Thus, skywave alone will raise the noise floor by several dB, and every dB of increased noise in the aeronautical HF bands will cause loss of vital communications.<sup>8</sup>

Moreover, the assumptions underlying NTIA’s analysis, however, introduce so much variation and error that the analysis they support cannot be relied upon to build a case for the use of the Aeronautical Mobile (R) bands by Access BPL providers. NTIA’s skywave analysis assumed a co-frequency distribution factor of 6 dB. In effect, this factor accounts for the assumption that only one in four devices is active on a given frequency at any given time.<sup>9</sup> The same analysis also assumed that Access BPL devices would be operating at 4 dB below the Part 15 limits. Both assumptions are unrealistic. BPL providers have an incentive to operate systems at the maximum permitted power levels at all times to reduce deployment costs and to minimize

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<sup>6</sup> NTIA Comments, Technical Appendix at 4-3.

<sup>7</sup> *Id* at 4-4.

<sup>8</sup> See Attachment B to these Reply Comments for a discussion of noise calculations and ARINC’s handling of traffic at the noise floor.

<sup>9</sup> NTIA Comments, Technical Appendix at 4-2.

customer complaints. At times of maximum demand, the assumption that only one in four devices is operating on a given frequency is also unrealistic, especially as systems mature. Together, these two assumptions account for 10 dB of NITA's 13 dB in adjustment factors.<sup>10</sup>

Thus, only by invoking extremely favorable – and often unrealistic assumptions – could one conclude on the basis of the analysis NTIA conducted that the increase in the noise floor at ground based aeronautical HF receive sites would be so small as 1 dB as a result of skywave propagation from Access BPL devices.<sup>11</sup> If the build up of noise from the skywave propagation of BPL signals is to become a problem, it will do so within a few years after the implementation of such operations on a widespread basis. If it will not be a problem, then time will bear out such claims. On the basis of the record to date, however, it would be foolish to risk endangering the lives of those who depend on HF service for aeronautical communications by authorizing Access BPL in the spectrum internationally allocated for safety services such as those conducted in the Aeronautical Mobile (R) bands.

## **II. The Record Reflects the Need to Adopt Measurement Procedures Geared to the Unique Challenges of Access BPL Operation.**

In its Comments, NTIA recommended use of 10 meters as the measurement distance.<sup>12</sup> NTIA also recommended that the FCC implement a uniform height of one meter above ground for making measurements in order to add a needed measure of safety in conducting such

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<sup>10</sup> NTIA also uses the term “median noise” implying that half of the days have more noise and half have less. The net effect of BPL operation would be to eliminate the low noise days. As discussed, *supra*, ARINC uses trained radio operators to work traffic on signals that often are at the noise floor. Under NTIA's analysis, the real noise floor would be increased substantially thereby resulting in a substantial loss of messages from aircraft.

<sup>11</sup> As discussed, *infra*, NTIA's use of a 5 dB height correction factor will still understate the actual BPL radiation at higher heights in many situations, but may be reasonable as a general assumption provided that Aeronautical Mobile (R) frequencies are not employed for Access BPL.

<sup>12</sup> NTIA Comments at 16.

measurements. NTIA then stipulated the use of a 5 dB correction factor to take into account the fact that the strength of radiated signals from Access BPL signals would usually be greater at higher heights due to the manner in which such signals would be radiated from power lines. This 5 dB factor, NTIA asserted, would account for some 80% of the signals emanating from power lines even though it recognized that signals could be up to 20 dB greater than those measured at one meter above ground.<sup>13</sup> Indeed, especially at the lower HF frequencies higher angles of radiation can be expected.<sup>14</sup> The 5 dB figure is obviously a compromise. Thus, while 5 dB may serve as a convenient correction factor, the facts that HF signals can propagate at angles that are higher than the horizon and at field strength levels that are much higher than would be predicted by the use of the 5 dB correction factor underscore the need to refrain from authorizing Access BPL within the Aeronautical Mobile (R) bands.

ARRL noted the debate over the correct fall off or attenuation factor to be used in predicting HF signal field strength at distances relatively close to the source.<sup>15</sup> The problem is that HF measurements will be made in the near field. As such, ARINC's analysis supports use of the 20 dB per decade factor instead of 40 dB per decade.<sup>16</sup> Access BPL behaves like a line source, not a point source. In the near field, signal strength drops off as  $1/R$  from a line or cylindrical source instead of  $1/R^2$ . Consequently, a factor such as 20 dB per decade is appropriate instead of 40 dB per decade..

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<sup>13</sup> *Id.* at 21.

<sup>14</sup> This is illustrated on page 17 of the simulation results set forth in Attachment A.

<sup>15</sup> ARRL Comments at Exhibit C, pages 17-20.

<sup>16</sup> See Attachment A to these Reply Comments.

### **III. Each Access BPL System Should be Certified Before Regular Operation is Authorized.**

In its Comments, ARINC noted the fallacies inherent in authorizing Access BPL operation on the basis of tests conducted on three supposedly representative systems.<sup>17</sup> There simply are too many different configurations of power lines and deployment modes for such a scheme to reflect accurately all of the likely implementations of Access BPL. For this reason ARINC called upon the Commission to require measurements of each Access BPL system. NTIA set forth similar rationales in recommending that the Commission clearly place the task of obtaining operating authority on those most responsible for maintaining compliance – the power systems that implement or allow the implementation of Access BPL systems on their lines.<sup>18</sup> Not only should such a system be implemented, Access BPL operators should have the obligation to facilitate continued compliance by making periodic measurements to assure that changes to power systems and/or their Access BPL implementations have not resulted in radiation in excess of that permitted under the rules.<sup>19</sup>

### **IV. Interference Prevention Techniques Must be a Part of the Access BPL Rules and Compliance Must Become a Part of the Culture of Access BPL Operations.**

The Commission must do more than suggest in “guidelines” that Access BPL devices incorporate interference mitigation techniques. The rules allowing the production, marketing, and use of such devices must make clear that, at a minimum, Access BPL devices are to incorporate circuitry allowing operators remotely to turn such devices on and off, to reduce the

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<sup>17</sup> ARINC Comments at 6.

<sup>18</sup> NTIA Comments at 14-15.

<sup>19</sup> As ARINC noted, cable television systems are under such a continuing obligation. ARINC Comments at 5.

power, and to change frequencies of operation. All Access BPL equipment should be frequency agile in 3 kHz bandwidth steps within the HF spectrum.<sup>20</sup>

ARINC's HF facilities are staffed and operating all of the time. A long response time to interference complaints should not be an option. The entity created to be the repository of Access BPL information must promptly provide information needed to initiate the resolution of Access BPL interference complaints. Access BPL operators, too, should be required to provide points of contact that are reachable 24 hours a day seven days a week to assist in the resolution of interference complaints. These points of contact must be more than mere telephone answering services. Those staffing such points must be capable of initiating remotely the steps needed to ascertain whether the interference complaints are likely due to Access BPL operations. If necessary, the point of contact should be empowered to require the dispatch of personnel to troubleshoot any complaints that cannot be satisfactorily resolved through remote manipulation of the Access BPL facilities. Only by mandating such steps and the eventual development of a culture of compliance can the Commission have any realistic expectation that Access BPL will not become a major source of interference to licensed communications.<sup>21</sup>

## **V. ARINC Continues to Experience Interference to HF Communications.**

In its Comments, ARINC noted that it had earlier reported interference to its receive station at Half Moon Bay, California. At the time the Comments were filed, ARINC engineers had just returned from conducting field measurements at Half Moon Bay in an effort to determine the

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<sup>20</sup> See NTIA Comments at 10.

<sup>21</sup> The Commission has heretofore experienced the "down side" of initiating new uses of the HF spectrum without rigorous controls. The 27 MHz Citizens Band Radio Service is such a case. Initially implemented in 1958 as an HF service instead of an expansion of the former UHF Citizens Band Service, the service grew but carried with it serious interference and enforcement problems due in large part to the physical properties of the spectrum employed for the service. Only decades of enforcement effort and the eventual introduction of widespread UHF based personal communications equipment and services such as cellular and PCS have caused the regulatory problems of this service to begin to fade into the background.



source of the interference. Attachment C to these Reply Comments sets forth a report on this work.<sup>22</sup> Ultimately, ARINC was able to trace three of the interfering signals to houses in the community of Half Moon Bay. ARINC continues to believe that the likely sources of this interference are Part 15 devices designed to transmit signals over power lines within houses and looks forward to working with the Commission in an effort to remedy the problem.

#### **VI. The Commission Should Reaffirm the Primacy of Licensed Services in the HF Bands.**

Regardless of whether the Commission implements Access BPL with a new subpart under Part 15 or adopts a new rule part altogether for this unlicensed service, the agency should reaffirm the primacy of licensed services operating in accordance with its rules and international allocations. Implementation of Access BPL will inevitably set up tensions between BPL users and providers on the one hand and licensees on the other. In order to minimize misunderstandings, any new rules should clearly stipulate that Access BPL is secondary to licensed services in that it must not cause harmful interference to licensed services and accept any interference received, including interference that may cause undesired operation. Just as Access BPL must accommodate existing licensed users, it must also be prepared to accommodate changes in the facilities employed in licensed services. While it is in ARINC's interest to seek relatively low noise receive sites, it is also inevitable that times will arise in which ARINC will need to move receive sites to new locations or activate other facilities, including transmitters, at new locations. At such times, Access BPL operators may have to make changes in their operations to accommodate the licensed services that ARINC provides. In adopting rules for Access BPL, the Commission should recognize that licensees will need the

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<sup>22</sup> ARINC's Comments reported that the measurements at Half Moon Bay revealed interfering signals as high as -80 dBm to -96 dBm on the basis of initial reports from the field. The attached report corrects this to note that the recorded signals were as high as -86 dBm and typically ranged from -100 to -90 dBm.

flexibility to change locations and it should warn Access BPL providers of their obligation to cooperate.

### **Conclusion**

While Access BPL holds the promise of another broadband path, it also runs the risk of creating substantial harmful interference to essential safety services such as those conducted using the Aeronautical Mobile (R) HF spectrum. If Access BPL is to be authorized on a regular basis, the Commission should refrain from allowing it in the Aeronautical Mobile (R) spectrum.

Respectfully submitted,

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By /s/ (electronically filed)

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